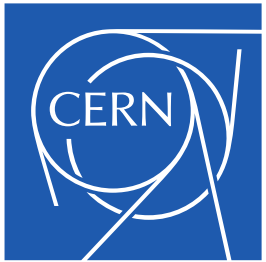



# Front-End Board Version 1 or Version 2 ??

23rd Jan 2020

Mark McLean

# Introduction

- V2 Front-End Board for the SEM Beam Position Monitors was developed with the aim of improving SNR and few other minor tweaks.
- Unfortunately it was not a clear improvement.
- First problem was a 250kHz signal around 100 bits in amplitude. This was traced to an oscillating power regulator and fixed.
- Second problem was an additional sensitivity to noise from the power supply. This was traced to the ASIC signal tracks being routed across a power plane.
- Beam sensitivity of both boards has been shown to be similar. $10^6$ $H^-$ ions gives a response of around 150 bits.

# Plan

- To combine the best features of V1 and V2 into a new V3 board. Changes from V1 will be minimal, to minimize risk.
- This board will be designed and manufactured in-house, we are meeting the Electronics Design Office tomorrow.
- Hoping that they will do the work of drawing V1 in the CERN supported software package (Altium). Then I will make some further changes in line with what we have learnt from V2. Design complete end February.

# Plan

- In March get a small number (**how many?)** of V3 boards manufactured by CERN or CERN controlled sub-contractors.
- Test on the bench in April, if no problems then commence volume manufacture of the bare PCBs (approx. 80).
- Test with beam in May, if no problems then populate the 80 PCBs with components and bond ASICs.
- This would give us the boards for the complete installation by end of June.

# Other issues – Back-End Boards

- Many (20 out of 43) Back-End Boards cannot be programmed. They have a visibly different memory chip fitted.

Good chip → 

← Bad chip

- I will obtain some alternative devices and test them.
- The Back-End boards also have the same oscillating regulator that caused problems with the Front-End boards, so I will have those changed too.

# Other issues – In-Out Boards

- The In-Out Board prototypes are not yet populated.
- Masaki will hand them over to me and I will sort it out…

# Grid inpection

- The GBar SEM and the SEM from the source have been removed.
- The GBar SEM had just one missing wire, as expected
- The source SEM has several broken wires
- The units are currently with Radio-Protection
- After that we will be able to inspect fully

# Thank you – The End

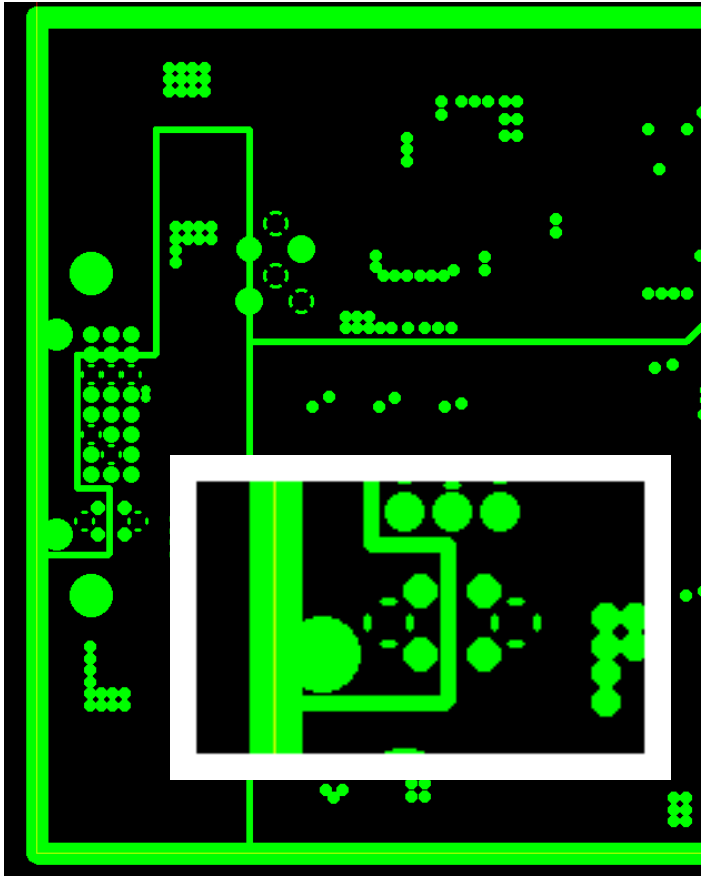
- Following slides are spares in case of questions

# Changes from V1

- Changes needed to V1 are:
  - Change the oscillating regulator to LT1962EMS8-5
  - Remove the GNDIO-AGND connection but add a link
  - Remove the trimmer
  - Make the LEDs different colours
  - R43 = 309R
  - C312 = 10k resistor
  - R80 = 1k
  - Q1 and Q2 replaced with BCM847
  - Ensure LT1964BYP used
  - Make provision to connect the ASIC pad to -2V

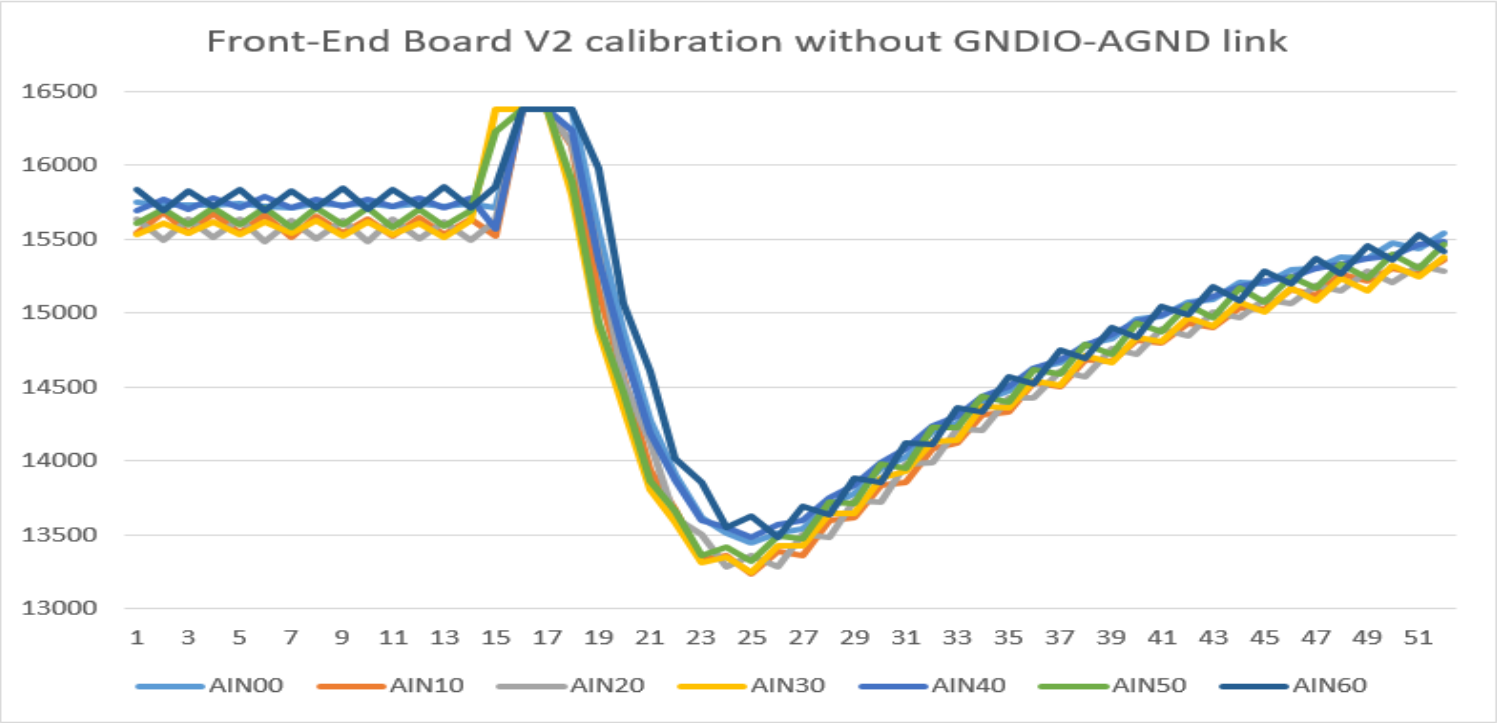
# Oscillating regulators

- V1 had an error which caused AGND and GNDIO to be connected. This made more capacitance available to the regulator and reduced the amount of noise at the power input connector.
- Thus the amplitude of the noise spread to the rest of the board was reduced in V1, and the problem was not noticeable.



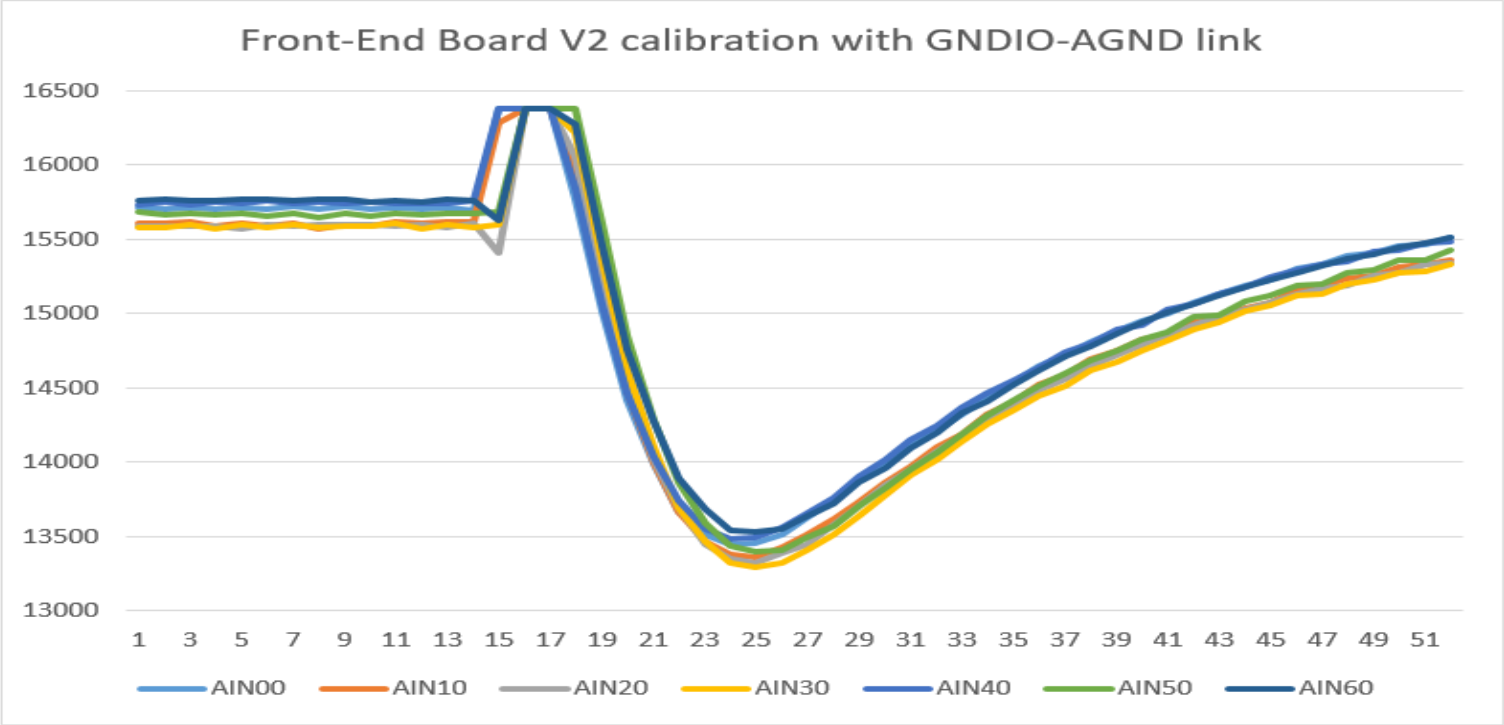
# Oscillating regulators

Calibration waveforms



# Oscillating regulators

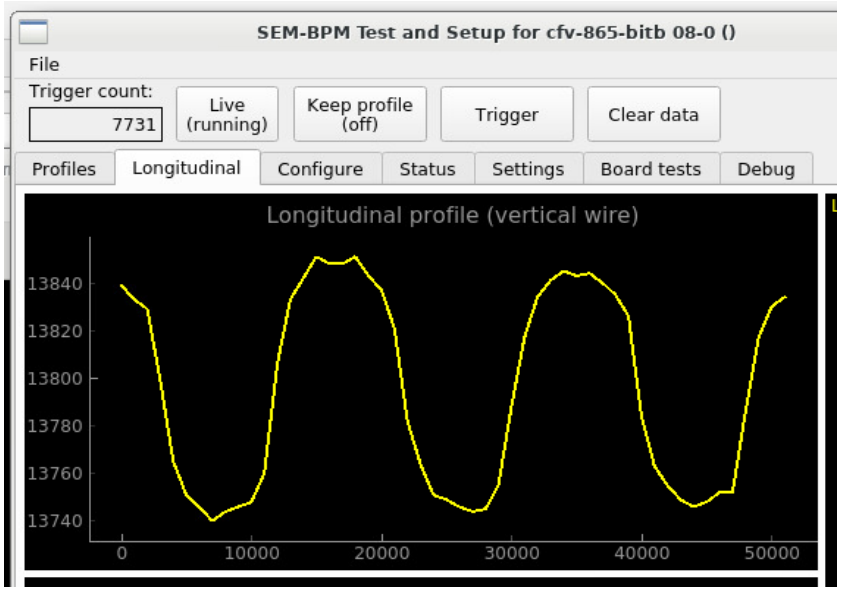
Calibration waveforms



# Nature of remaining noise

- The big clue came from comparing the amplitude of the signal from different inputs, particularly while the cleaner was using a vacuum cleaner nearby!

| Input | PCB Layer | Noise amplitude |
|---|---|---|
| AIN01 | Un-bonded | <10 bits |
| AIN20 | Layer 1 | 20 bits |
| AIN21 | Layer 10 | 100 bits |
| AIN35 | Layer 10 | 100 bits |
| AIN36 | Layer 1 | 30 bits |
| AIN58 | Un-bonded | <10 bits |



# Nature of remaining noise

- It turns out that in V1, all the signal tracks were on the top or bottom layers of the board and were adjacent to a ground plane.
- But in V2, half the signal tracks are on a buried layer and the adjacent layer is a power plane.